CERN – LHC NEWS 2011

WEBSITE: TAKING AT CLOSER LOOK AT LHC

Standard Model Higgs boson mass constrained to the range 115-130 GeV.

In a seminar held at CERN On December 13th, the ATLAS and CMS experiments presented the status of their searches for the Standard Model Higgs boson. Their results are based on the analysis of considerably more data than those presented at the summer conferences, sufficient to make significant progress in the search for the Higgs boson, but not enough to make any conclusive statement on the existence or non-existence of the elusive Higgs. The main conclusion is that the Standard Model Higgs boson, if it exists, is most likely to have a mass constrained to the range 116-130 GeV by the ATLAS experiment, and 115-127 GeV by CMS. Tantalising hints have been seen by both experiments in this mass region, but these are not yet strong enough to claim a discovery.

CERN PRESS RELEASE December 2011.

December 13, 2011, Update on the Standard Model Higgs searches in ATLAS and CMS . On the 12th December the CERN council will meet and announce the latest news about the search for the Higgs boson to its member states. This will be done in closed meetings but the next day the spokespersons for CMS and ATLAS will deliver 30 minute talks each in public. There will then be a discussion period of one hour. Hopefully this indicates that some meaningful result has been obtained and they will be able to tell us what the Higgs mass is or that it does not exist in the Standard Model form.

CERN PUBLIC SEMINAR.

LHC proton run for 2011 reaches successful conclusion. After some 180 days of running and four hundred trillion ($4x10^{14}$) proton proton collisions, the LHC's 2011 proton run came to an end at 5.15pm yesterday evening. For the second year running, the LHC team has largely surpassed its operational objectives, steadily increasing the rate at which the LHC has delivered data to the experiments.

CERN PRESS RELEASE, NOVEMBER 2011

Upstream from OPERA: extreme attention to detail. In the last days of Setember 2011, at a seminar held at CERN, the OPERA collaboration revealed their astonishing observation: neutrinos might move faster than light. The finding is currently under scrutiny in the scientific community. While the result downstream at Gran Sasso speaks for itself, upstream at CERN things are no less intriguing, with high-tech GPS systems, novel techniques for accurately measuring the time, and unique ways keeping the initial particle beam stable. Take away one ingredient and the accuracy needed for the final measurement is spoiled.
CERN THE Bulletin – October 2011

OPERA experiment reports anomaly in flight time of neutrinos. Even though this news does not come from LHC, we consider that it must be brought to this section.
The OPERA result is based on the observation of over 15000 neutrino events measured at Gran Sasso, and appears to indicate that the neutrinos travel at a velocity 20 parts per million above the speed of light, nature's cosmic speed limit. Given the potential far-reaching consequences of such a result, independent measurements are needed before the effect can either be refuted or firmly established. This is why the OPERA collaboration has decided to open the result to broader scrutiny.
CERN PRESS RELEASE, SETEMBER 2011

Oscillation matter-antimatter at LHCb. Results to be presented by CERN1's LHCb experiment at the biennial Lepton-Photon conference in Mumbai, India on Saturday 27 August are becoming the most precise yet on particles called B mesons, which provide a way to investigate matter-antimatter asymmetry. *"This result puts us right where we need to be to start finding cracks in the Standard Model, and explaining matter-antimatter asymmetry."* said LHCb spokesperson Pierluigi Campana.
CERN PRESS RELEASE SETEMBER 2011

LHC passes 2 fb^{-1} . The LHC is enjoying a confluence of twos. On 5 August the total integrated luminosity delivered in 2011 passed 2 fb^{-1}; the peak luminosity has risen to over $2 \times 10^{33} cm^{-2} s^{-1}$; and fill number 2006 lasted for 26 hours, delivering an integrated luminosity of 100 pb^{-1}.
CERN COURIER AUGUST 2011

LHC experiments present latest results at Mumbai conference. Results from the ATLAS and CMS collaborations, presented at the biennial Lepton-Photon conference in Mumbai (India)

August 2011. today, show that the elusive Higgs particle, if it exists, is running out of places to hide. Proving or disproving the existence the Higgs boson is among the main goals of the LHC scientific programme. ATLAS and CMS have excluded the existence of a Higgs over most of the mass region 145 to 466 GeV with 95 percent certainty.
CERN PRESS REALISE AUGUST 2011

LHC achieves 2011 data milestone. In June the LHC made good the promise of delivering an integrated luminosity of 1 fb^{-1} to the general-purpose detectors, ATLAS and CMS. This was the target for 2011 and it was achieved a little before the middle of the year. At the same time, making use of a technique known as "luminosity levelling", the LHCb experiment had already recorded around 0.36 fb^{-1}, well on the way to achieving its 1 fb^{-1} by the end of the year.
CERN COURIER JULY 2011

Large Hadron Collider results excite scientists. The Large Hadron Collider (LHC) has picked up tantalising fluctuations which might - or might not - be hints of the sought-after Higgs boson particle.
But scientists stress caution over these "excess events", because similar wrinkles have been detected before only to disappear after further analysis.
Either way, if the sub-atomic particle exists it is running out of places to hide, says the head of the European Organization for Nuclear Research (Cern), which runs the LHC.
BBC July 2011.

The first fill with 1380 bunches per beam went into physics. Over the last three months the LHC has been gradually stepping up the total number of bunches in the beams and, early on Tuesday 28 June, the first fill with 1380 bunches per beam went into physics.
At present, the spacing between the bunches in the LHC is 50 ns, with some bigger gaps here and there to allow the injection and extraction kickers to do their job. The maximum number of bunches that we can inject in the machine with a 50 ns spacing is 1380, which is indeed the target for 2011. A nominal LHC bunch contains around 1.15×10^{11} protons. The 1380 nominal bunches now in use gives a total of 1.6×10^{14} protons per beam and a combined energy of around 89 MJ at 3.5 TeV. The machine protection system is working very well.
After 2012 LHC will be filled with 2808 bunches to run at maximum energy (360 MJ at 7 TeV)
CERN BULLETIN JULY 2011

Bringing heavy-ion physics into a new era of high precision studies. The three LHC experiments that study lead ion collisions all presented their latest results at the annual Quark Matter conference, held this year in Annecy, France. The results are based on analysis of data collected during the last two weeks of the 2010 LHC run, when the LHC switched from protons to lead-ions. All experiments report highly subtle measurements, bringing heavy-ion physics into a new era of high precision studies.

"These results from the LHC lead ion programme are already starting to bring new understanding of the primordial universe," said CERN[1] Director General Rolf Heuer. *"The subtleties they are already seeing are very impressive."*

LHC Experiments Present New Results at Quark Matter 2011 Conference

CERN PRESS RELEASE JUN 2011.

The number of bunches per beam reached a new record. The LHC has spent the last couple of weeks delivering collisions to the four main experiments. At the same time the number of bunches in the beam has been steadily increased.

On April 10 the number of bunches per beam reached 1020, with a total of 10^{14} protons per beam – another record for the LHC.

CERN COURIER MAY 2011

LHC sets world record beam intensity. Geneva, 22 April 2011. Around midnight this night CERN's Large Hadron Collider set a new world record for beam intensity at a hadron collider when it collided beams with a luminosity of 4.67 x $10^{32}cm^{-2}s^{-1}$. This exceeds the previous world record of 4.024 x $10^{32}cm^{-2}s^{-1}$, which was set by the US Fermi National Accelerator Laboratory's Tevatron collider in 2010, and marks an important milestone in LHC commissioning.

The current LHC run is scheduled to continue to the end of 2012. That will give the experiments time to collect enough data to fully explore the energy range accessible with 3.5 TeV per beam collisions for new physics before preparing the LHC for higher energy running. By the end of the current running period, for example, we should know whether the Higgs boson exists or not.

CERN PRESS RELEASE April 2011.

A new lumninosity record. After about one month of operation, the LHC has already accumulated an integrated luminosity of 28 pb^{-1}, which corresponds to over 50% of the total

delivered to the experiments in 2010. This impressive start to the LHC run in 2011 bodes well for the rest of year.

CERN THE BULLETIN MARCH 2011.

Protons will be colliding in the four LHC experiments by mid-March. On Saturday, Feb. 19, the LHC began circulating particle beams for the first time since the accelerator's 10-week technical stop. Scientists plan to start colliding protons in the four LHC experiments by mid-March.

Although scientists will not bring the beams to an energy above last year's record of 3.5 TeV, they plan to increase the number of particles they accelerate, multiplying the number of collisions that take place in the detectors.

SYMMETRYBREAKING FEBRUARY 2011

CERN announces LHC to run in 2012. CERN today announced that the LHC will run through to the end of 2012 with a short technical stop at the end of 2011. The beam energy for 2011 will be 3.5 TeV. This decision, taken by CERN management following the annual planning workshop held in Chamonix last week and a report delivered today by the laboratory's machine advisory committee, gives the LHC's experiments a good chance of finding new physics in the next two years, before the LHC goes into a long shutdown to prepare for higher energy running starting 2014.Geneva, 31 January 2011.

CERN PRESS RELEASES JAN 2011.

CMS announces first results of search for SUSY. The CMS collaboration have announced the first results of its search for supersymmetry (SUSY) at the LHC.

SUSY is one of the strong candidates for physics beyond the Standard Model that could be detected in proton–proton collisions at the LHC. If it exists in nature, it could solve many of the outstanding issues. SUSY can reveal itself through the production of new heavy particles and so could deliver a natural candidate particle to explain the large density of dark matter in the universe.

CERN COURIER JAN 2011.

LHC plans extra year for Higgs hunt. Scientists are preparing to run the LHC for an extra year (8 TeV energy in center of mass). If the plan is implemented, LHC will run until the end of 2012 — rather than 2011 — before entering a year-long shutdown for a major upgrade. The energy in

The decision comes with the belief that new discoveries may be just around the corner. "It would be a shame to stop," says Steve Myers, who is responsible for maintaining and upgrading the accelerator. The decision will be discussed at LHC Performance Workshop will take place from 24 until 28 January 2011 in Chamonix, and should be finalized shortly after.
NATURE News.

LHC among Physics World' top 10 breakthroughs for 2010. Physicsworld.com (A website from the Institute of Physics -IOP) has included among its top 10 breakthroughs for 2010 the Large Hadron Collider. In March, LHC physicists achieved the first 7 TeV proton–proton collisions ever achieved in a particle accelerator. And what's more, in November the LHC moved seamlessly into the business of colliding lead ions in a successful bid to recreate the conditions of just after the Big Bang. Both runs generated copious amounts of data that will keep physicists busy until the accelerator starts up again next year.
Moreover, Physics World has decided to award the *Physics World 2010 Breakthrough* of the Year to two international teams of physicists at CERN (ASACUSA and ALPHA), who have created new ways of controlling antiatoms of hydrogen.
Physics World, Dec 20, 2010.